Noise Measurement Amplifier

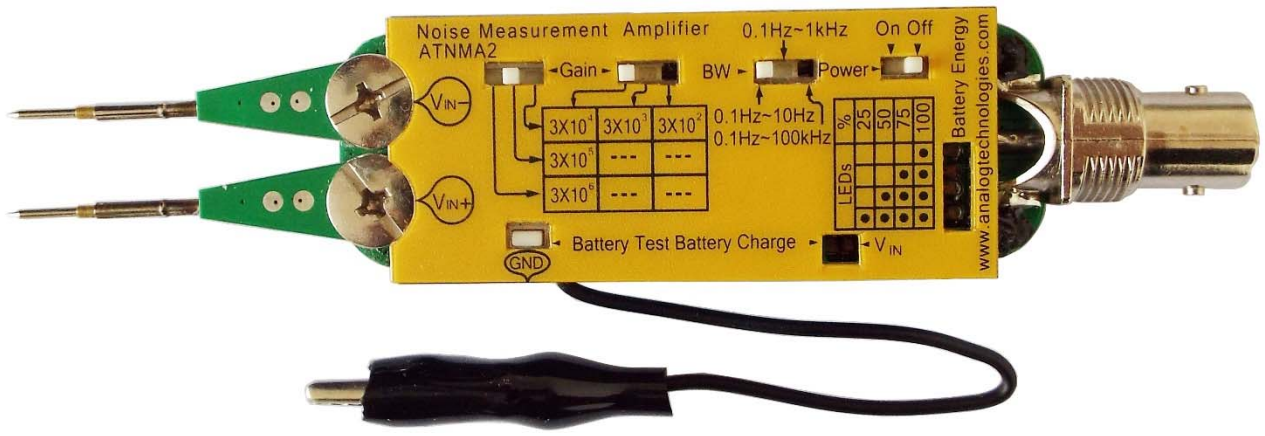


Figure 1. The Physical Photo of ATNMA2

MAIN FEATURES

Built-in rechargeable battery

Magnifications: 300×, 3,000×, 30,000×, 300,000×, 3,000,000×

Three filter bandwidths: 0.1Hz ~ 10Hz, 0.1Hz ~ 1kHz, 0.1Hz ~ 100kHz

LED low battery indicator function

BNC output terminal

Input probes with adjustable span

100 % Lead (Pb)-free and RoHS Compliant

INTRODUCTION

This noise measurement amplifier, ATNMA2, is designed to test ultra-low noises, which cannot be measured by an oscilloscope, such as nanovolt or microvolt level noises, for electronic modules. This amplifier measures the noise signals through touching the point that needs testing, then amplifies the detected noise signals, and select the measuring range of frequencies. The rechargeable battery energy is 500mAH, can be used for more than 20 hours. The rechargeable battery full voltage is 4.2V. The low noise amplifier includes one rechargeable battery, one coaxial cable, and some probes.

This noise measurement amplifier assembly has 5 portions:

1. Amplification Magnifications

3000×:

Measure the noises between 1μV to 100μV, toggle magnification switch S2 to S2-1 and S5 to S5-1.

30,000×:

Measure the noises between 0.03μV to 0.3μV, toggle magnification switch S2 to S2-2 and S5 to S5-2.

300,000×:

Measure the noises less than 0.1μV, toggle the magnification switch S2 to S2-3 and S5 to S5-3.

3,000,000×:

Measure the noises less than 10nV, toggle the magnification switch S2 to S2-3 and S5 to S5-3.

Please see the switch locations in Figure 2.

2. Noise Measurement Range

Noise measurement ranges include: 0.1Hz ~ 10Hz, 0.1Hz ~ 1 kHz and 0.1 Hz ~ 100 kHz. The specific locations please see figure 2.

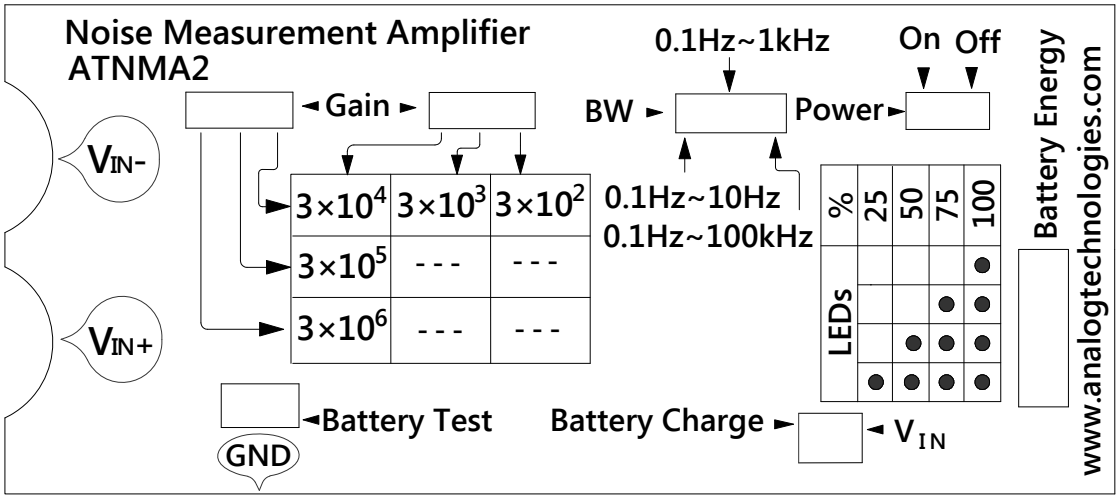


Figure 2. Functions and Locations of ATNMA2

3. Battery Capacity Monitoring

Observe battery LEDs when turning on the battery indicator switch. When four power indication LEDs all lit, it means the battery is full, and the battery voltage is more than 3.8V; three power indication LEDs on, the battery voltage is more than 3.6V; two power indication LEDs lit, the battery voltage is more than 3.4V; if only one LED is on, the battery voltage is more than 3.2V, and then the circuit does not work well, recharging the battery is necessary, otherwise the battery will be damaged. Please see the capacity monitor demonstration in Figure 3.

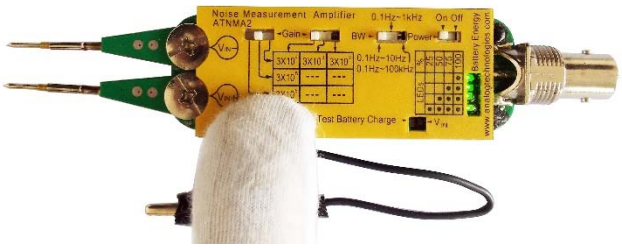


Figure 3. Capacity Monitor of ATNMA2

4. Battery Charging Display

The Charging display LEDs LED 5 and LED 6 will be on when charging well. Only when the charging voltage exceeds 7.2V or less than the battery voltage, LED 5 turns off; LED 6 is lit when in charging mode. Battery charging display shows in Figure 4.

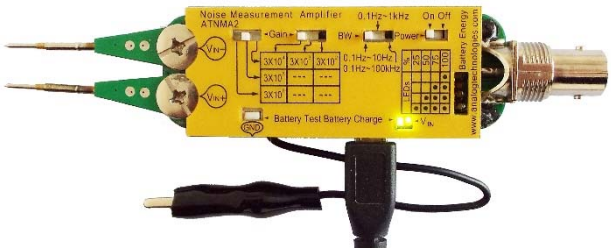


Figure 4. Charging Display of ATNMA2

5. Battery Indication

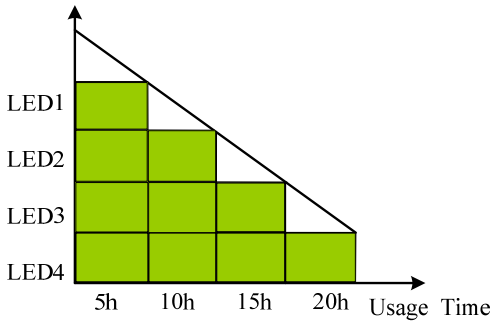


Figure 5. Power Show Time of ATNMA2

INPUT AND OUTPUT MODLE

Rotatable Probe Input:

Adjust the angles of the spring probe to make it contact the point to be tested. Hold the amplifier by hand just like a pen. Two probes contact with together, open an angle of more than 70°.

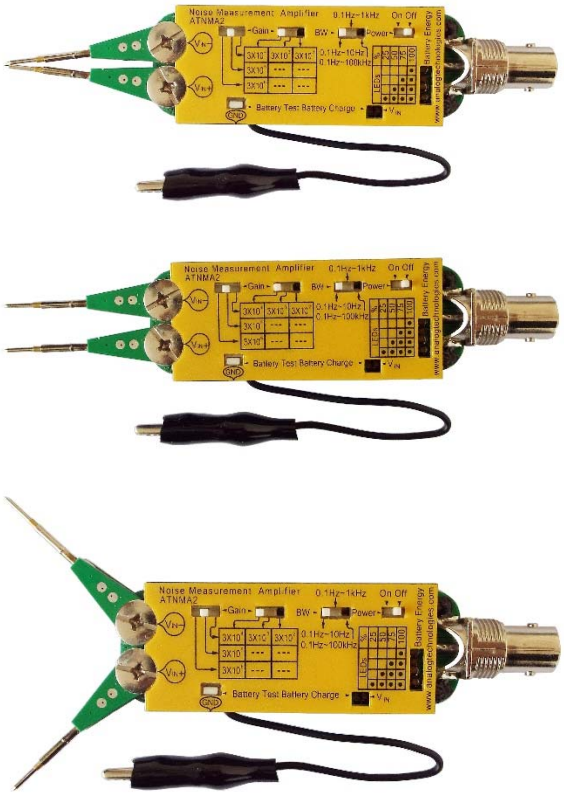


Figure 6. Probe Angle of ATNMA2

Coaxial cables output: Use the coaxial cable to connect the BNC and oscilloscope. The type of the coaxial cable line is SYV-50-2-41.

APPLICATION METHOD

Adjust the angles of the spring probe angles to contact the point to be tested by two screws, connect the coaxial cable well, and push on the power switch. At this time, press the monitoring battery switch, and the power indication LEDs lit. Then select the filter frequency range, toggle two switches at the same time and observe the oscilloscope and adjust suitable magnifications (The oscilloscope waveform is observable but not saturated).

CALCULATION METHOD

To calculate the ultimate noise value, two data need to be measured. One data is $V_{O(P-P)}$, the noise value when there's no power supply module; and the other is $V_{C(P-P)}$, the noise value when it's working well. The formula is as follows.

$$V_{IN-TOT-PP} = \frac{V_{OUT-PP}}{G} \quad (1)$$

$$V_{IN-TOT-RMS} = \frac{V_{IN-TOT-PP}}{6.6} \quad (2)$$

$$V_{IN-TOT-RMS} = \sqrt{V_{IN-AMP-RMS}^{\ 2} + V_{N-DUT-RMS}^{\ 2}} \quad (3)$$

$$V_{N-DUT-RMS} = \sqrt{V_{IN-TOT-RMS}^{\ 2} - V_{IN-AMP-RMS}^{\ 2}} \quad (4)$$

$$V_{N-DUT-PP} = V_{N-DUT-RMS} \times 6.6 \quad (5)$$

V_{OUT-PP} is the peak to peak voltage of the tested circuit with power supply from oscilloscope;

G is magnification of the noise measurement amplifier;

$V_{IN-TOT-PP}$ is the total peak to peak voltage of the input terminal;

$V_{IN-TOT-RMS}$ is the total root mean square voltage of the input terminal;

$V_{IN-AMP-RMS}$ is the root mean square voltage of noise measurement amplifier;

$V_{N-DUT-RMS}$ is the root mean square voltage of device under test;

$V_{N-DUT-PP}$ is the final peak to peak noise value of the device under test ;

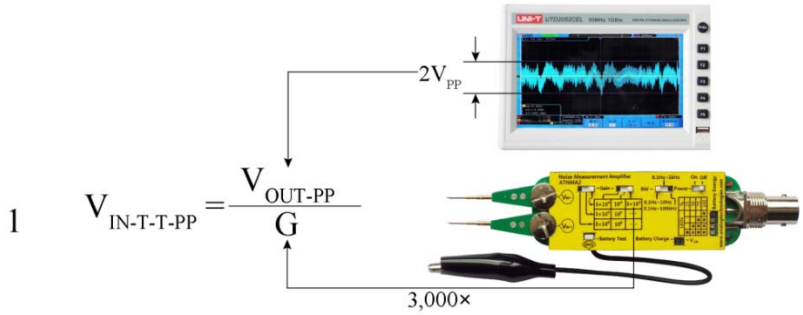
$V_{N-DUT-RMS}$ is the final root mean square noise value of the device under test .

AMPLIFIER ITSELF NOISE

Table 1 shows the amplifier itself noise at different frequency.

Table 1.

Bandwidth	Amplifier Noise
0.1Hz~10Hz	150nV
0.1Hz~1kHz	600nV
0.1Hz~100kHz	800nV



1 $V_{IN\text{-}T\text{-}T\text{-}PP} = \frac{V_{OUT\text{-}PP}}{G}$

2 $V_{IN\text{-}TOT\text{-}RMS} = \frac{V_{IN\text{-}TOT\text{-}PP}}{6.6}$

3 $V_{IN\text{-}TOT\text{-}RMS} = \sqrt{V_{IN\text{-}AMP\text{-}RMS}^2 + V_{N\text{-}DUT\text{-}RMS}^2}$

4 $V_{N\text{-}DUT\text{-}RMS} = \sqrt{V_{IN\text{-}TOT\text{-}RMS}^2 - V_{IN\text{-}AMP\text{-}RMS}^2}$ ←

DUT Result For RMS Noise

0.1Hz~10Hz	1.3μV
0.1Hz~1kHz	2.5μV
0.1Hz~100kHz	20μV

5 $V_{N\text{-}DUT\text{-}PP} = V_{VN\text{-}DUT\text{-}RMS} \times 6.6$

Figure 7. Calculation Formula Diagram of ATNMA2

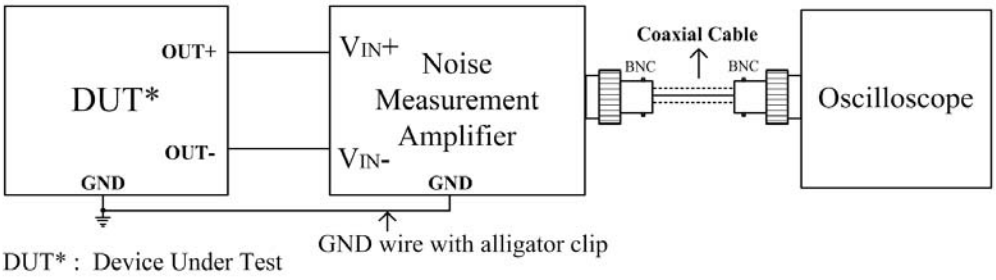


Figure 8. Application Drawing of ATNMA2

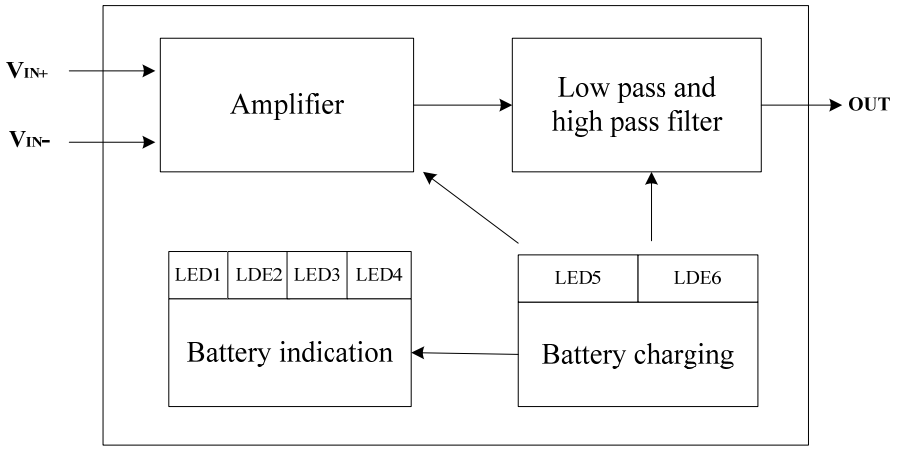
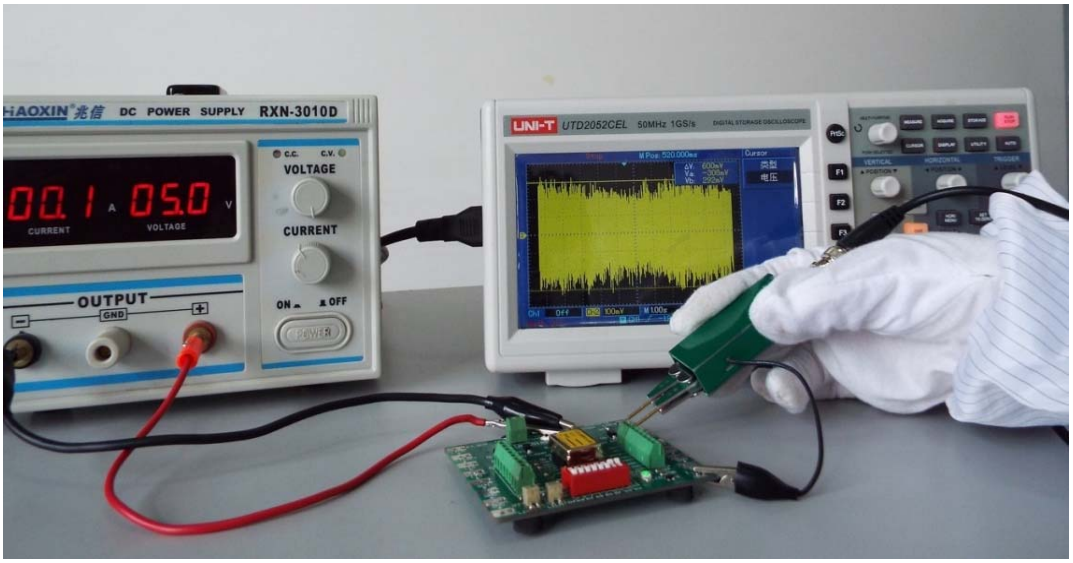


Figure 9. Internal Block Diagram of ATNMA2

APPLICATION PRESENTATION



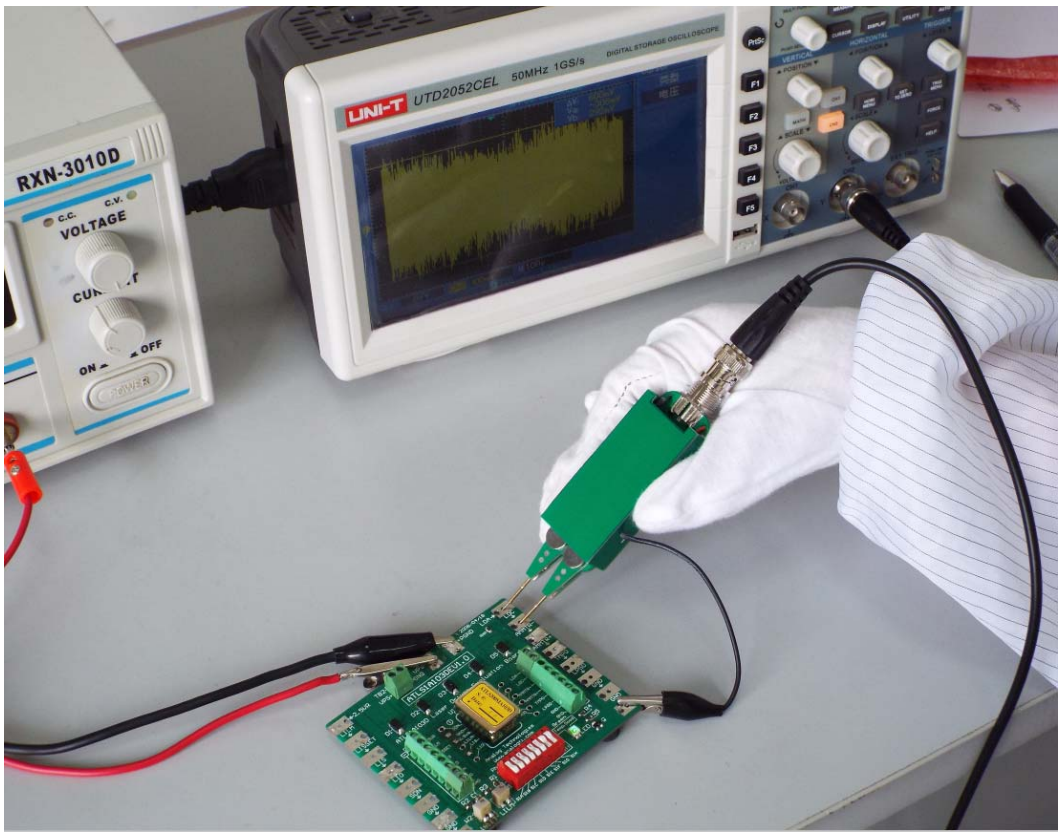


Figure 10. Application Presentation Photo of ATNMA2

Figure 11. Side View of ATNMA2

ACCESSORIES

Figure 12. BNC-BNC Connector 1.5m Coaxial Cable

Figure 13. Charger and USB cable of ATNMA2

ORDERINGINFORMATION

Table 2. Part Number

Part #	Description	Unit Price
ATNMA2	Noise Measurement Amplifier	$189

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